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Service
Manual

CULLIGAN®
MARK 100
AUTOMATIC
WATER CONDITIONER
MODELS FROM 2000

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Printed in USA

Attention Culligan Customer:

The installation, service and maintenance of this equipment should be rendered by a qualified and trained service technician. Your local independently operated Culligan dealer employs trained service and maintenance personnel who are experienced in the installation, function and repair of Culligan equipment. This publication is written specifically for these individuals and is intended for their use.

We encourage Culligan users to learn about Culligan products, but we believe that product knowledge is best obtained by consulting with your Culligan dealer. Untrained individuals who use this manual assume the risk of any resulting property damage or personal injury.

⚠ WARNING - Prior to servicing equipment, disconnect power supply to prevent electrical shock.

⚠ WARNING - If incorrectly installed, operated or maintained, this product can cause severe injury. Those who install, operate, or maintain this product should be trained in its proper use, warned of its dangers, and should read the entire manual before attempting to install, operate or maintain this product.

IF THIS EQUIPMENT IS TO BE USED IN THE TREATMENT OF DRINKING WATER, THE WATER MUST BE MICROBIOLOGICALLY SAFE.

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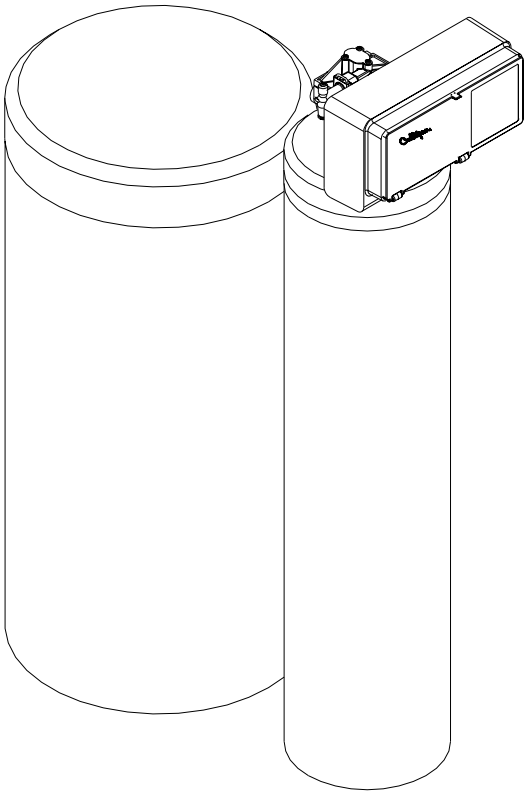

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Introduction

The Culligan® Mark 100 water softeners are tested and validated by WQA against ANSI/NSF Standard 44 for the effective reduction of calcium and magnesium, along with Barium and Radium 226/228*.

SAFE PRACTICES

Throughout this manual there are paragraphs set off by special headings.

NOTICE: Notice is used to emphasize installation, operation or maintenance information which is important, but does not present any hazard.

Example: NOTICE: *The nipple must extend no more than 1 inch above the cover plate.*

⚠ **CAUTION**: Caution is used when failure to follow directions could result in damage to equipment or property. Example:

⚠ **CAUTION:** ***Disassembly while under water pressure can result in flooding.***

⚠ **WARNING**: Warning is used to indicate a hazard which could cause injury or death if ignored. Example:

> ⚠ **WARNING! ELECTRICAL SHOCK HAZARD! UNPLUG THE UNIT BEFORE REMOVING THE COVER OR ACCESSING ANY INTERNAL CONTROL PARTS.**

SERIAL NUMBERS

The control valve serial number is located on the back of the timer case.

The media tank serial number is located on the top surface of the tank.

NOTICE: *Do not remove or destroy the serial number. It must be referenced on request for warranty repair or replacement.*

This publication is based on information available when approved for printing. Continuing design refinement could cause changes that may not be included in this publication.

* Verified using hardness surrogate per ANSI/NSF Standard 44.

Specifications

Culligan® Mark 100 Water Conditioners with Time Clock, Aqua-Sensor® Device or Soft-Minder® Meter

	9” Model	12” Model
Control Valve	5-cycle, Reinforced Thermoplastic	5-cycle, Reinforced Thermoplastic
Overall Conditioner Height	51 in	51 in
	1 295 mm	1 295 mm
Media Tank Dimensions (Dia x Ht)	9 x 45 in	12 x 45 in
	229 x 1 143 mm	305 x 1 143 mm
Salt Storage Tank Dimensions (Dia x Ht)	16 x 43 in	18 x 43 in
	406 x 1 092 mm	457 x 1 092 mm
	18 x 43 in	
	457 x 1092 mm	
Exchange Media, Type and Quantity	Cullex® Media, 0.86 ft³	Cullex® Media, 1.4 ft³
	Cullex® Media, 24.5 L	Cullex® Media, 40 L
Underbedding, Type and Quantity	Cullsan® Underbedding, 12 lb	Cullsan® Underbedding, 30 lb
	Cullsan® Underbedding, 5.4 kg	Cullsan® Underbedding, 14 kg
Exchange Capacity	17,500 gr @ 4.0 lb	24,100 gr @ 6.0 lb
@ Salt Dosage Per Recharge[1]	1 133 g @ 1.8 kg	1 560 g @ 2.7 kg
	23,900 gr @ 8.0 lb	34,500 gr @ 12.0 lb
	1 547 g @ 3.6 kg	2 234 g @ 5.4 kg
	26,600 gr @ 12.0 lb	41,900 gr @ 18.0 lb
	1 722 g @ 5.4 kg	2 713 g @ 8.1 kg
Freeboard to Media[2]	16.6-17.6 in	17.5-18.5 in
	420-447 mm	444-470 mm
Freeboard to Underbedding[3]	39.2 in	38.5 in
	996 mm	978 mm
Salt Storage Capacity	250 lb or 375 lb	375 lb
	114 kg or 170 kg	170 kg
Rated Service Flow @ Pressure Drop	7.5 gpm @ 15 psi	7.5 gpm @ 15 psi
	30 Lpm @ 102 kPa	31 Lpm @ 102 kPa
Total Hardness, Maximum	75 gpg	99 gpg
	1 283 mg/L	1 692 mg/L
Total Iron, Maximum	5 ppm	5 ppm
	5 mg/L	5 mg/L
Hardness to Iron Ratio, Minimum	8 gpg to 1 ppm	8 gpg to 1 ppm
	140 mg/L to 1 mg/L	140 mg/L to 1 mg/L
Operating Pressure	20-125 psi	20-125 psi
	140-860 kPa	140-860 kPa
Operating Temperature	33-120°F	33-120°F
	1-50°C	1-50°C
Electrical Requirements	120V/60 Hz	120V/60 Hz
Electrical Power Consumption, Min/Max	3 Watts/35 Watts	3 Watts/35 Watts
Drain Flow, Maximum[4]	2.0 gpm	3.5 gpm
	8 Lpm	14 Lpm
Recharge Time, Average[5]	80 min	85 min
Recharge Water Consumption, Average	45 gal	86 gal
	170 L	325 L

1 Capacities and corresponding salt dosages pertain to low hardness waters. Capacities given are per recharge
2 Measured from top of media to top of inlet fitting (backwashed and drained).
3 Measured from top of underbedding to top of inlet fitting.
4 Backwash at 120 psi (830 kPa).
5 10 minute backwash, 7 lb (3.2 kg) 9” model or 13 lb (5.9 kg) 12” model salt dosage at 30 psi (204 kPa).

Familiarization

Control

The Culligan® Mark 100 water softener uses the same power valve control as in our Culligan Mark 89/812 models. It can be programmed as either a time clock, Aqua-Sensor® sensing device or Soft-Minder® meter model. Each model has its own programming parameters which can be set to control the operation and regeneration of the system. These functions are outlined in Table 1.

TABLE 1

Function	Time Clock	Soft-Minder Meter	Aqua-Sensor Sensing Device
1. Time of Day	YES	YES	YES
2. Time of Regen.	YES	YES	YES
3. Not Used	NO	NO	NO
4. Salt Dosage	YES	YES	YES
5. Backwash Time	YES	YES	YES
6. Brine Rinse Time	YES	YES	YES
7. Hardness Level	NO	YES	NO
8. Gallons Capacity / Regen. Interval	YES	YES	NO
8A. Forced Regeneration Interval	NO	YES*	YES*
9. Lock/Unlock display	YES	YES	YES
10. Blanking Feature	YES	YES	YES

** When dip switch #10 is in the ON position*

During the programming stage, the user will be prompted to enter the appropriate parameter. Refer to the programming section for further information.

Circuit Board

The AccuSoft™ microprocessor circuit board controls every function of the Culligan Mark 100 water softener. This board has several unique features which allow it to perform a variety of functions. Familiarization of the board is essential for a thorough understanding of the softener.

The AccuSoft™ circuit board has a set of default settings that the microprocessor will reset to whenever any dip switches are flipped, or if a meter or Aqua-Sensor cable is attached or removed while the power is on the the control. Table 2 is a list of the default microprocessor settings.

It is reccomended to always disconnect the power from the circuit board prior to replacing an Aqua-Sensor probe or Meter cable so that the programmed settings are not lost.

TABLE 2

1	Time of Day	12:00 A.M.
2	Time of Regeneration	2:00 A.M.
3	Chlorination (Not Used)	10 min.
4	Salt Dosage	10 lb., 9” 16 lb., 12”
5	Backwash Time	10 min.
6	Brine Rinse	71 min., 9” 59 min., 12”
7	Hardness	20 GPG
8	Regeneration Interval	3 days
9	Display Blanking	Enabled
10	Display Lock Out	Disabled

Programming Switches

The circuit board will require the proper setting of the dip switches in order to function properly. Figure 1 shows the dip switches.

Switch 1 - Sets the unit in the Run or Test mode.
Switch 2 - Sets the unit for Filter or Softener.
Switch 3 - Sets the flow meter K factor for the 3/4" or 1-1/4" flow meter.
Switch 4 - Sets the control for 9” or 12” diameter tanks.
Switch 5 - Sets the unit for the standard or accelerated Refill cycle.
NOTICE: For an accelerated Refill cycle, the refill flow control in the brine refill assembly must be changed to PN 00-4016-23.
Switch 6 - Sets the unit for immediate or delayed regeneration.
Switch 7 - Sets the unit to measure in liters and French or German hardness, or in gallons and the conventional gpg hardness.
Switch 8 - Sets the unit to display time with a 24 or 12 hour clock.
Switch 9 - Sets the unit for either French or German hardness degrees when switch #7 is in the ON position.
Switch 10 - When turned ON, the microprocessor will force a regeneration based on the setting 8A in the menu.

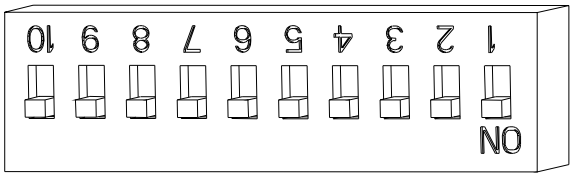


FIGURE 1

Dip Switch	Function	Default (OFF) Position
1	Run or Test Mode	Run Mode
2	Filter or Softener	Softener
3	Flow Meter K Factor (3/4" or 1-1/4")	3/4" Flow Meter
4	9"-12" Tank Settings	9" Tank
5	Standard vs. Accelerated Refill	Standard Refill
6	Delay vs. Immediate Regeneration	Delayed Regeneration
7	English vs. Metric Settings	English Settings
8	12 or 24 Hour Clock	12 Hour Clock
9	German or French Hardness Degrees	German (When #7 is ON)
10	Time Clock Backup	No Forced Regeneration

Auxiliary Connections

Refer to Figure 2 for all circuit board connections. Power terminals are located along the lower section of the circuit board. The connection marked 'POWER' is for the transformer connector, and the motor connection is marked 'MOTOR'. The connection for the cam switch harness, marked 'CAM', is located in the upper right corner near the dip switches. The Aqua-Sensor sensing device connection is located in the lower center of the board, just above the power connectors, while the Soft-Minder connection is located in the upper left side of the board. Just below the meter connection is a connection marked 'BATT', which is for the optional battery back-up. All terminals are clearly marked to ease installation.

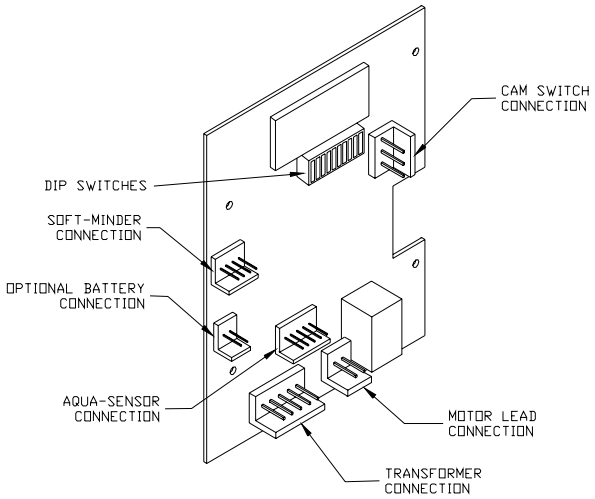


FIGURE 2

Aqua-Sensor® Operation

The Aqua-Sensor® models contain a feature which can automatically detect when the brine solution has been rinsed through the Cullex® media. This feature will advance the control to the next position when it senses that the brine has been rinsed out prior to the time set in the brine rinse option. The Brine/Rinse time can be manually raised or lowered in the microprocessor.

Tables 3A and 4A show the total capacity of the Aqua-Sensor® unit at various salt dosages, along with the average capacity used prior to a signal calling for a regeneration.

To view the length of the last Brine/Rinse cycle, press the STATUS button until the display is blank. Press the down arrow until the number 15 is illuminated. See the Service Check section for more information.

Soft-Minder® Operation

The microprocessor automatically calculates the gallons of water which can be treated based on the salt dosage, the water hardness, and the tank size. Numeric enunciator 8 will display the GALLONS TO SIGNAL for regeneration (the portion of the capacity which is held in reserve is not displayed).

NOTICE: Changes to the salt dosage, or water hardness will not immediately update the GALLONS TO SIGNAL setting. The control will recalculate the setting upon completion of a regeneration cycle.

As an option GALLONS TO SIGNAL for regeneration can be set to directly override the calculation through numeric enunciator 8. The gallon value can be raised or lowered to meet the needs of your specific application. The control must be cycled through a complete regeneration before the gallon override setting is stored by the microprocessor.

NOTICE: Changing the capacity will affect the reserve capacity. An INCREASE in the gallons capacity will DECREASE the reserve capacity. A DECREASE in the gallons capacity will INCREASE the reserve capacity. Refer to Tables 3B and 4B to determine the units total capacity based on salt dosage and the hardness level.

The gallons remaining can be viewed by pressing the STATUS button until the display is blank. Press the down arrow until the number 15 is illuminated. The value in the display must be multiplied by 10 to determine the actual gallons remaining before the unit calls for a regeneration. The unit will initiate an immediate regeneration if dip switch 6 in the ON position. See the Service Check section for more information.

Regeneration

There are several conditions that will cause the control to trip a regeneration. The 'REGEN' enunciator will light when the control has signaled for a regeneration. The 'REGEN' enunciator will flash while the control is in regeneration.

The following are conditions that will call for regeneration:

1. When the Aqua-Sensor® probe senses the hardness in the Cullex® media.
2. When the Soft-Minder® meter has recorded the passage of a predetermined number of gallons.
3. When the time clock has counted past the set number of days.
4. At the preset time, when the number of days without a regeneration is equal to the days set in menu #8A.
5. At the preset time, when the 'REGEN.' button is depressed once. 'REGEN.' will light.
6. Immediately, when the 'REGEN." button is depressed twice. 'REGEN.' will light and blink.
7. Immediately, if power to the unit has been off for more than 3 hours.

If dip switch 6 is in the ON position the unit will begin a regeneration immediately for instances 1 and 2. With dip switch 6 in the OFF position, the regeneration will not begin until the preset regeneration time.

Display Blanking

As shipped from the factory, the display of the board will turn off if there has been no keypad activity for a 1 minute period. To have the display constantly lit, press the STATUS button until the number 10 icon is lit. Next, press the UP arrow. A “d” for disable will appear in the display. To have the display blank again , press the UP arrow. An “E” will appear in the display .

Display Lockout

The Culligan® Mark 100 control is equipped with a new feature which will allow you to protect the programmed settings from tampering by unauthorized individuals. When the lockout feature is activated, the only parameter which can be adjusted is the Time-of-Day.

To activate the lockout feature, press the STATUS button until the number 9 icon is illuminated. A “U” for unlock will be displayed. Press the UP and DOWN arrows simultaneously. A “L” for lock will appear along with an icon of a lock. All program parameters, except time of day, are now frozen at their current settings. To disable this feature, press the UP and DOWN arrows simultaneously.

Power Loss

The AccuSoft® circuit board is equipped with a Hi-Cap Capacitor and EEPROM memory chip. The capacitor is capable of maintaining the time, for at least one day, in the event of a power outage. The EEPROM ensures that the individual programming parameters of the softener are not lost.

If the power outage lasts long enough to drain the Hi-Cap Capacitor, the control will flash "12:00 PM" when power is returned to the control. The unit will continue to keep time from the moment power is restored, and will initiate a full regeneration at the preset regeneration time. The time of day will need to be reset in order to return the regeneration to its preset time.

Failure Mode

The Culligan Mark 100 control is equipped to detect a motor or piston which is locked in a frozen position. The AccuSoft™ circuit board will apply power to the motor for 30 seconds. If there is no change in the motor homing or position switch, the control will power down for 90 seconds. The circuit board will repeat this procedure two more times in an attempt to remove the obstruction. If no movement has been detected, the control will permanently power down and a phone icon will appear in the display. The phone indicates that a service call is required to fix the control. To return to the service mode, turn off the power to the unit for 1 full minute and remove the obstruction to the motor or piston.

TABLE 3A - CAPACITY, 9" AQUA-SENSOR® SENSING DEVICE (GALLONS)

SALT DOSAGE	"A" DIMENSION				HARDNESS													
	160 LB INCH(CM)	250 LB INCH(CM)	375 LB INCH(CM)		1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75
8	14-3/4	9-1/4	7-1/2	TOTAL CAPACITY	4,900	2,450	1,633	1,225	980	817	700	613	544	490	445				
	(37.5)	(23.5)	(19.1)	CAPACITY TO SIGNAL	3,537	1,949	1,179	1,004	707	590	505	442	393	354	322				
12	21-3/4	15-3/4	11-3/8	TOTAL CAPACITY	5,420	2,710	1,807	1,355	1,084	903	774	678	602	542	493	452	417	387	301
	(55.2)	(40.0)	(26.9)	CAPACITY TO SIGNAL	3,656	1,828	1,219	914	731	609	522	457	406	366	332	305	281	261	244

TABLE 3B - CAPACITY, 9" SOFT-MINDER® METER (GALLONS)

SALT DOSAGE	"A" DIMENSION				HARDNESS													
	160 LB INCH(CM)	250 LB INCH(CM)	375 LB INCH(CM)		1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75
4	7-3/4	4-5/8	3-1/4	TOTAL CAPACITY	3,220	1,610	1,073	805	644	537									
	(19.7)	(11.7)	(8.9)	CAPACITY TO SIGNAL	2,596	1,298	849	637	495	412									
8	14-3/4	9-1/4	7-1/2	TOTAL CAPACITY	4,900	2,450	1,633	1,225	980	817	700	613	544	490	445				
	(37.5)	(23.5)	(19.1)	CAPACITY TO SIGNAL	3,314	1,657	1,084	813	631	526	442	387	333	300	267				
12	21-3/4	15-3/4	11-3/8	TOTAL CAPACITY	5,420	2,710	1,807	1,355	1,084	903	774	678	602	542	493	452	417	387	361
	(55.2)	(40.0)	(26.9)	CAPACITY TO SIGNAL	3,656	1,828	1,195	896	696	580	987	426	367	331	294	270	246	229	209

TABLE 4A - CAPACITY, 12" TIME CLOCK AND AQUA-SENSOR® SENSING DEVICE (GALLONS)

SALT DOSAGE	"A" DIMENSION				HARDNESS													
	160 LB INCH(CM)	250 LB INCH(CM)	375 LB INCH(CM)		1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-60	61-70	71-80	81-90	91-99
12	21-3/4	15-3/4	11-3/8	TOTAL CAPACITY	6,740	3,370	2,247	1,685	1,348	1,123	963	843	749	674	562				
	(56.2)	(40.0)	(28.9)	CAPACITY TO SIGNAL	4,542	2,271	1,514	1,136	908	757	649	568	505	454	379				
18	N/A	24-1/2	17-1/4	TOTAL CAPACITY	7,660	3,830	2,553	1,915	1,532	1,277	1,094	958	851	766	638	547	479	426	383
		(62.2)	(43.8)	CAPACITY TO SIGNAL	5,200	2,600	1,733	1,300	1,040	867	743	650	578	520	433	371	325	289	260

TABLE 4B - CAPACITY, 12" SOFT-MINDER® METER (GALLONS)

SALT DOSAGE	"A" DIMENSION				HARDNESS													
	160 LB INCH(CM)	250 LB INCH(CM)	375 LB INCH(CM)		1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-60	61-70	71-80	81-90	91-99
6	14-3/4	7-3/8	5-1/2	TOTAL CAPACITY	4,520	2,260	1,507	1,130	904	753	646	565							
	(37.5)	(18.7)	(14.0)	CAPACITY TO SIGNAL	3,495	1,748	1,143	857	666	555	466	408							
12	21-3/4	15-3/4	11-3/8	TOTAL CAPACITY	6,740	3,370	2,247	1,685	1,348	1,123	963	843	749	674	562				
	(56.2)	(40.0)	(28.9)	CAPACITY TO SIGNAL	4,832	2,416	1,580	1,185	920	767	644	564	486	437	357				
18	N/A	24-1/2	17-1/4	TOTAL CAPACITY	7,660	3,830	2,553	1,915	1,532	1,277	1,094	958	851	766	638	547	479	426	383
		(62.2)	(43.8)	CAPACITY TO SIGNAL	5,346	2,673	1,748	1,311	1,018	849	713	624	537	484	395	335	286	246	219

Programming

The display will initially power up flashing "12:00 PM". After 1 minute the motor will energize and cycle the control, without stopping, to the home position. This is required to ensure that the control is in the home position.

FIGURE 3 - Circuit Board Display

The timer uses four buttons:

1. STATUS: Advance timer through display options.
2. UP ARROW: Increase the setting.
3. DOWN ARROW: Decrease the setting.
4. REGEN.: Initiate a manual regeneration.

SETTING THE MICROPROCESSOR

The microprocessor senses when it is installed as a Soft-Minder or Aqua-Sensor® control. Adding or removing any connection to the board, or flipping any of the dip switches will automatically reset the microprocessor to the factory settings.

1. With a flashing or blank display, pressing the status button twice will move to the **Time-of-Day** adjustment, adjust the time by using the up and down arrows. A number "1" will appear at the bottom of the display while in this mode.

Press ▲ to increase or
▼ to decrease

2. Press status again, this displays the **Time-of-Regeneration** for delayed units, adjust using the up and down arrows. A number "2" will appear at the bottom of the display while in this mode.

Press ▲ to increase or
▼ to decrease

3. Press status again, the number "3" will appear at the bottom of the display. **This setting is not used**, and any changes made will not affect the operation of the microprocessor.

Press ▲ to increase or
▼ to decrease

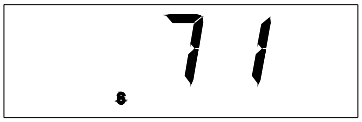
4. Pressing status again will show the **Salt Dosage**. This can be adjusted with the up and down arrows, the range is 3-15 lbs. for the 9" controls and 5-24 lbs. on 12" controls. A number "4" will appear at the bottom of the display while in this mode.

Press ▲ to increase or
▼ to decrease

5. Press status again, this displays the **Backwash Time** in minutes. The setting can be adjusted between 5 and 40 minutes by using the up and down arrows. A number “5” will appear at the bottom of the display while in this mode.

Press ▲ to increase or
▼ to decrease

6. Press status again to display the **Brine/Rinse Time** in minutes. The settings can be adjusted using the up and down arrows (37-85 min for 9”, 35-89 min for 12”). A number “6” will appear at the bottom of the display while in this mode.



Press ▲ to increase or
▼ to decrease

7. Press status again to display the **Hardness Level** in grains per gallon. The setting can be adjusted from 2-99 gpg by using the up and down arrows. This screen will not appear when the Aqua-Sensor® probe is attached. A number “7” will appear at the bottom of the display while in this mode.

Press ▲ to increase or
▼ to decrease

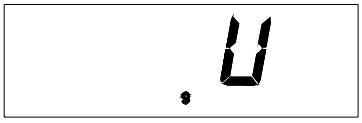
8. Press status again, for time clock models the display will show the **Regeneration Interval**. The setting can be adjusted using the up and down arrows. Controls with a Soft-Minder® meter will display the **Gallons to Signal** (multiply the displayed value by 10). A number “8” will appear at the bottom of the display while in this mode.

Press ▲ to increase or
▼ to decrease

8A. Display menu '8A' will light when dip switch #10 is in the ON position. This is the **Time Clock Backup** feature. The control will force a regeneration, within a range of 1-42 days, when in the Aqua-Sensor® or Soft-Minder® meter mode.

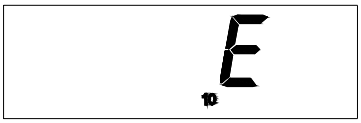
Press ▲ to increase or
▼ to decrease

9. Pressing status again will display the **Lock/Unlock** feature. A “U” in the display signifies an unlocked microprocessor, while a “L” will lock the settings except for the time of day. To toggle between the two settings press both arrow keys simultaneously. A number “9” will appear at the bottom of the display while in this mode.



Press ▲ simultaneously
▼

10. Pressing status again brings up the ability to **Enable/ Disable** the screen blanking. To have the display constantly lit, press the up arrow, a “d” for disable will appear in the display. Pressing the up arrow again displays an “E”, signifying that display blanking is enabled. A number “10” will appear at the bottom of the display while in this mode.



Press ▲ to change

NOTICE: Programming changes are not locked into the microprocessor memory until the control completes a regeneration cycle. To initiate a manual regeneration, press the REGEN. button twice, the "REGEN" enunciator will flash on the display. Refer to the Manual Cycling section on how to step through the regeneration stages.

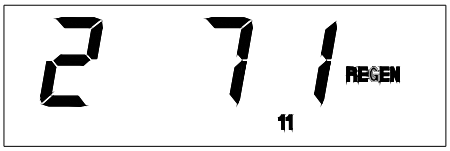
Manual Cycling

The Culligan® microprocessor can be indexed through the various regeneration stages. For all steps, the cycle numbers do not appear, or change, until the motor stops.

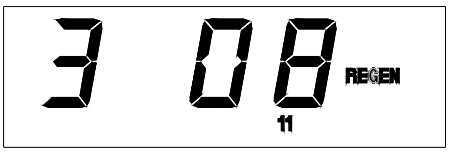
1. Press the status button to move past steps 1-10 until the display is blank. Push the up arrow. The number “11” icon will light up. An "H" will appear in the display. The control is in the HOME position. Pressing the regen button once will light the 'REGEN' icon.

2. Press the regen button one more time. The 'REGEN' icon will blink, and the motor will advance the control. A '1' will appear. The unit is now in the BACKWASH position. The numbers to the right indicate the time remaining for the cycle.

3. Press the up arrow. A '2' will appear in the display, along with the cycle time remaining. The control is in the BRINE DRAW/SLOW RINSE cycle.

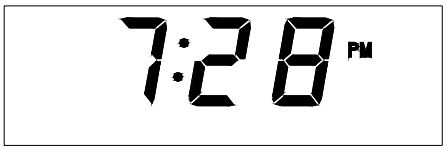


4. Press the up arrow. A '3' will appear in the display, along with the cycle time remaining. The control is now in the FAST RINSE/BRINE REFILL cycle.



5. Press the up arrow. An 'H' will appear in the display. The unit is in the HOME position. The 'REGEN' enunciator is no longer blinking.

6. Press the status key. Time-of-Day appears in the display.



Service Check

The service check mode allows one to view the instantaneous flow rate, the days since the last regeneration, the total number of regenerations, the regenerations in the past fourteen days, and the gallons remaining.

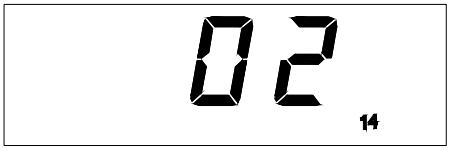
To enter the service check mode, follow these steps:

1. Press the status key to move past steps 1-10 until the display is blank.
2. Push the down arrow. The number '12' will appear only when the Soft-Minder® meter is connected. The display reads the gallons per minute flow rate. This screen will update with the current meter reading every 6 seconds.

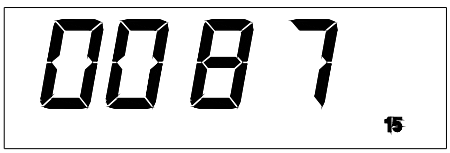
3. Press the down arrow. The number '13' and an "A" will light at the bottom of the display. The display will indicate the number of regenerations that have occurred in the last 14 days.

4. Press the down arrow. The number '13' and a 'B' will light at the bottom of the display. The display will indicate the total number of regenerations this control has cycled through.

5. Press the down arrow. The number '14' will light at the bottom of the display. The number in the display indicates the number of days since last regeneration.



6. Press the down arrow. The number '15' will be displayed if the flow meter or Aqua-Sensor® is connected. For the controls with the Soft-Minder® meter, the display indicates the gallons remaining before the unit signals for regeneration (multiply the displayed number by 10). For Aqua-Sensor® controls, the number indicates the total minutes of the last brine rinse cycle.



NOTICE: Pushing the up arrow at any of these displays will immediately bring you to the control position display, the number '11' will light at the bottom of the display.

Board Diagnostics

Board Diagnostic

To enter the board test mode, flip all of the dip switches to the ON position. All the segments of the board will light until either a key is depressed, an option is changed or a CAM micro switch changes position. Pressing one of the keys, closing a micro switch or turning OFF a dip switch will cause a different segment to light as outlined in Table 5.

A balanced signal should be applied to the Aqua-Sensor® pin connector. This can be done with a clean Aqua-Sensor probe and a fully regenerated bed or with the Aqua-Sensor Tester, PN 01-0079-99.

An unbalanced signal will cause the drive motor to run continuously. A balanced signal will cause the motor to stop.

This test can be used to check the integrity of the Aqua-Sensor probe. If the probe is connected to the board and the drive motor runs continuously, the probe should be cleaned and checked.

TABLE 5

ACTION	SEGMENT
UP KEY	1
DOWN KEY	2
REGEN KEY	3
STATUS KEY	4
CLOSED HOMING SWITCH	5
CLOSED PROGRAM SWITCH	6
FLOW METER CABLE PLUGGEDIN	7
AQUA-SENSOR PROBE PLUGGED IN	8
WATER FLOW	9 (Fluttering)
DIP SWITCH 1	SOFTWARE VERSION
DIP SWITCH 2	"1111"
DIP SWITCH 3	"2222"
DIP SWITCH 4	"3333"
DIP SWITCH 5	"4444"
DIP SWITCH 6	"5555"
DIP SWITCH 7	"6666"
DIP SWITCH 8	"7777"
DIP SWITCH 9	"8888"
DIP SWITCH 10	"9999"

Familiarize yourself with the replacement procedures and component parts thoroughly before attempting any repair.

> **WARNING! DISCONNECT ALL ELECTRICAL POWER TO THE UNIT BEFORE SERVICING. BYPASS THE UNIT AND RELIEVE SYSTEM PRESSURE BEFORE ATTEMPTING REPAIR.**

Circuit Board

To replace the AccuSoft$_{TM}$ circuit board, refer to the parts list and proceed as follows:

1. Remove the timer cover be removing the two screws located in the front of the cover.

2. Swing the circuit board mounting plate out, and lift it off of the two hinge posts.

3. Remove all connected wire leads from the board.

> **CAUTION:** ***Grip all connections to the circuit board by the connecting terminals for assembly and disassembly. Failure to do so could result in damage to the wire leads or connecting terminals***

4. Remove the four screws holding the board to the mounting plate. See Figure 4.

> **CAUTION:** ***Do not touch any surfaces of the circuit board. Electrical static discharges may cause damage to the board. Handle the AccuSoft$_{TM}$ circuit board by holding olny the edges of the circuit board. Keep replacement boards in their special anti-static bags until ready for use. Mishandling of the circuit board will void the warranty.***

5. The new circuit board can be installed by reversing the steps 1-4 above.

> **CAUTION:** ***The wire connectors must be connected to the circuit board properly. The wires must exit the plug-in connector opposite of the raised white base of the circuit board connector.***

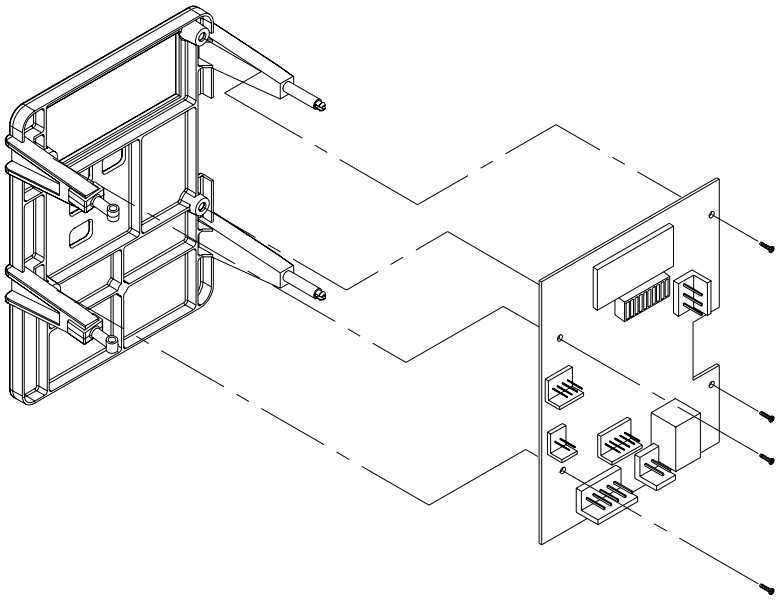


FIGURE 4

Refer to Figure 5 for assembly and disassembly of the various valve components listed below.

Drive Motor Assembly

1. Remove the drive motor cam switches by removing the one screw holding the switches to the motor
2. Remove the E-ring holding the drive motor cam to the camshaft with a flat tip screwdriver.
3. Lift the cam off the shaft.
4. Using a 1/4" hex driver, remove the bolt above the eductor piston assembly.
5. Loosen the two screws holding the yoke support plate and the motor to the control valve.
6. Remove the yoke support plate and yoke by gently pulling them down.
7. Fully remove the two screws holding the motor to the control. The motor will pull away from the control and the backplate will be hanging free.

NOTICE: If the unit is equipped with a meter, it is recommended to unclip the meter cable from the meter body to allow backplate movement. The Aqua-Sensor probe will have to be disconnected from the circuit board and the strain relief in the backplate will need to be removed.

NOTICE: Care should be taken to not damage the brine piston if it is not going to be replaced. The brine piston will need to be twisted slightly in order to remove it from the motor die casting.

This procedure can be followed in the reverse order to reassemble the backplate and motor to the control. When reassembling the scotch yoke, the yoke must slide into the yoke support plate prior to pushing the assembly up into the piston end and follower. Figure 6 shows proper assembly of the yoke into the support plate.

NOTICE: The seal pack may need to be repositioned in order for the follower to be inserted into the yoke, using the motor and backplate to push the seal pack fully into the valve is helpfull in aligning the yoke. Make sure that the follower is in the follower slot on the yoke, and that the end of the piston rod is held in the end of the yoke.

NOTICE: When attaching the support plate be certain to push up on the plate until the two mounting screws bottom in the U-shaped channels of the support plate.

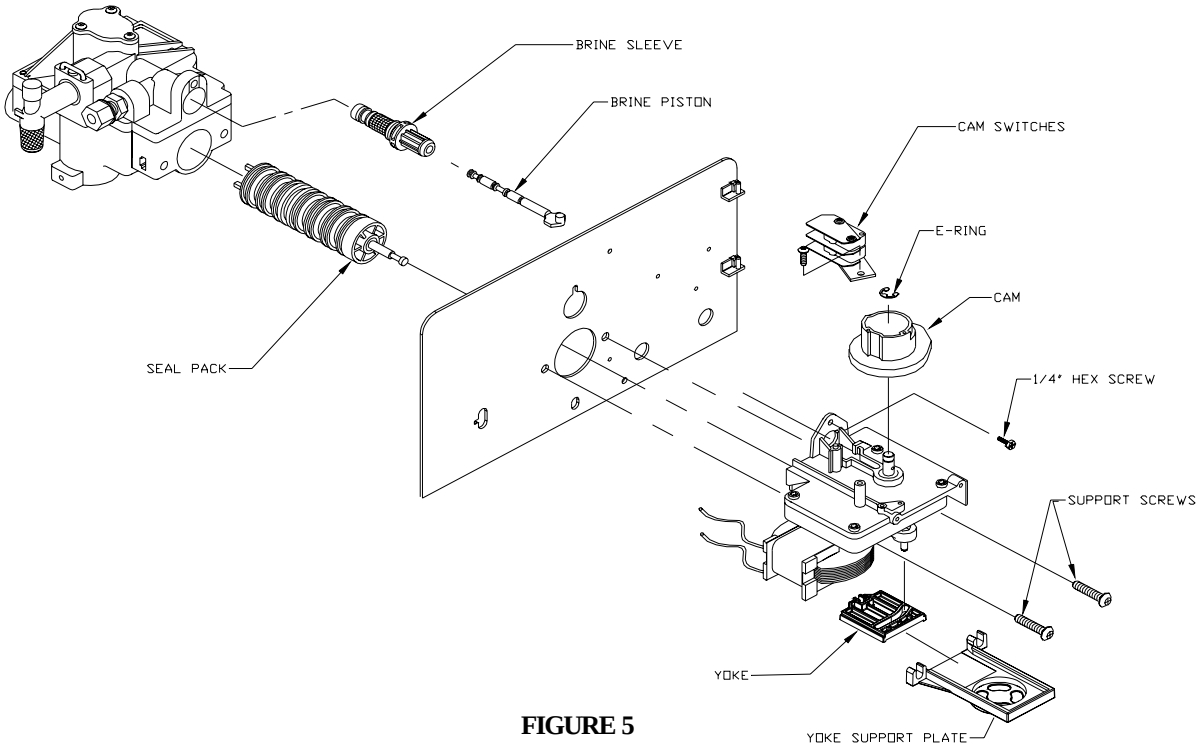


FIGURE 5

Seal Pack Assembly

Follow the instructions for the replacing drive motor assembly through step 7, then continue as follows:

1. With the drive motor and backplate set aside, firmly pull the seal pack assembly from the valve body.
2. Lightly lubricate the o-rings of the replacement seal pack with silicone grease.
3. Reverse the procedure for reassembly.

NOTICE: Use only silicone grease; petroleum-based lubricants will cause the degradation of the rubber components.

⚠ **CAUTION:** ***Do not twist the seal pack upon insertion. This can cause the outer o-rings to pinch, cut, or crimp.***

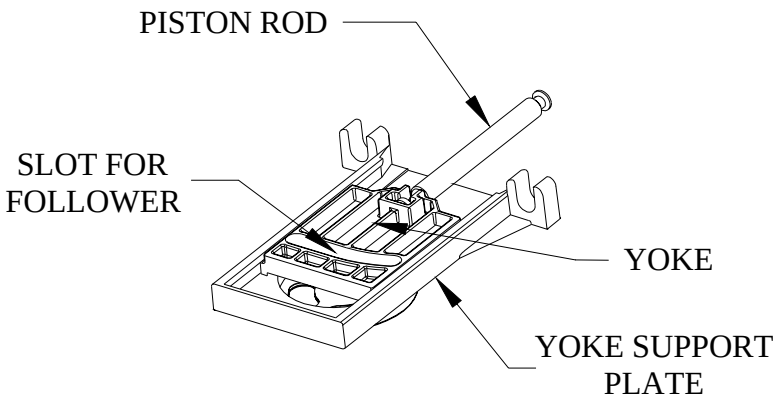


FIGURE 6

Eductor Piston/ Eductor Sleeve Assembly

Follow the instructions for the replacing drive motor assembly through step 7, then continue as follows:

1. With the drive motor and backplate set aside, firmly pull the eductor piston & sleeve assembly from the valve body.
2. Lightly lubricate the o-rings of the replacement piston & sleeve assembly with silicone grease.
3. Reverse the procedure for reassembly.

NOTICE: Use only silicone grease; petroleum-based lubricants will cause the degradation of the rubber components.

NOTICE: The eductor piston & sleeve assemblies are unique to the softener, filter, and Super S_{TM} controls. Refer to the parts list to ensure that the proper assembly is used.

Eductor Assembly

Refer to Figure 7 and the following instructions for replacement of the eductor:

1. Remove the three screws and the eductor plate
2. Remove the eductor screen by lifting it from the eductor body.
3. Remove the eductor body by grasping one of the projections with the pliers and gently pulling upward.
4. Reverse the procedure to reassemble. Be certain that the replacement eductor body contains the correct eductor nozzle.

TABLE 6 - Eductor Selection

Model	Nozzle Color	Nozzle P/N
9" Mark 100	Blue	00-4460-38
12" Mark 100	Beige	00-4460-38

Backwash Flow Control

Refer to Figure 7 and the following instructions for replacement of the backwash flow control:

1. Remove the drain elbow retaining clip from the valve body.
2. Pull the drain elbow from the valve body.
3. Remove the flow control from the valve body control and replace with a new flow restrictor.

NOTICE: the number on the backwash flow control should face into the valve body.

4. Reverse the procedure to reassemble. Be certain that the replacement is the correctly sized flow restrictor.

TABLE 7 - Backwash Flow Restrictor Selection

Model	Color & Number	P/N
9" Mark 100	Brown, #2	00-3316-35
12" Mark 100	Dark Green, #3	00-3316-36

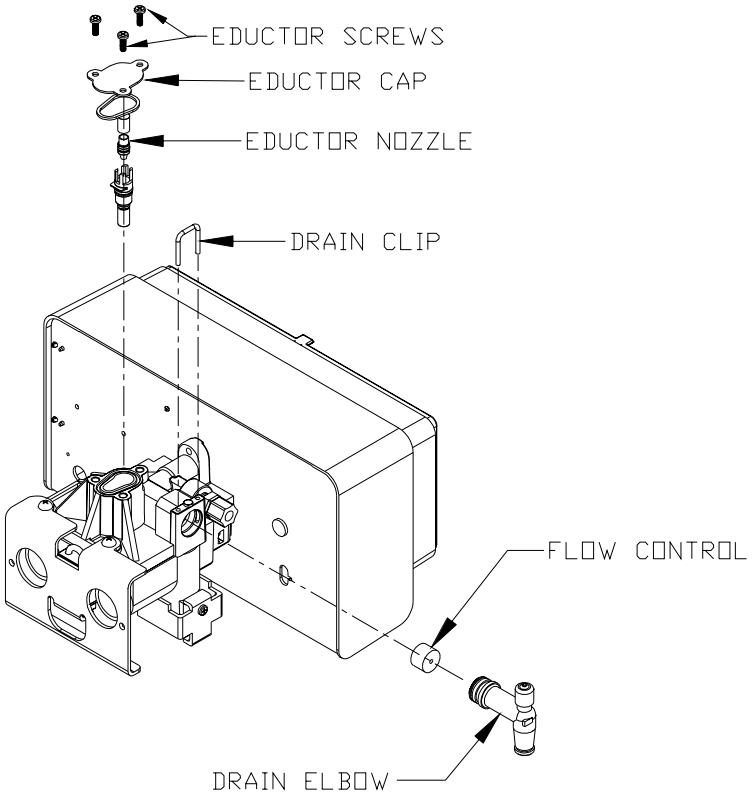


FIGURE 7

Troubleshooting Guide

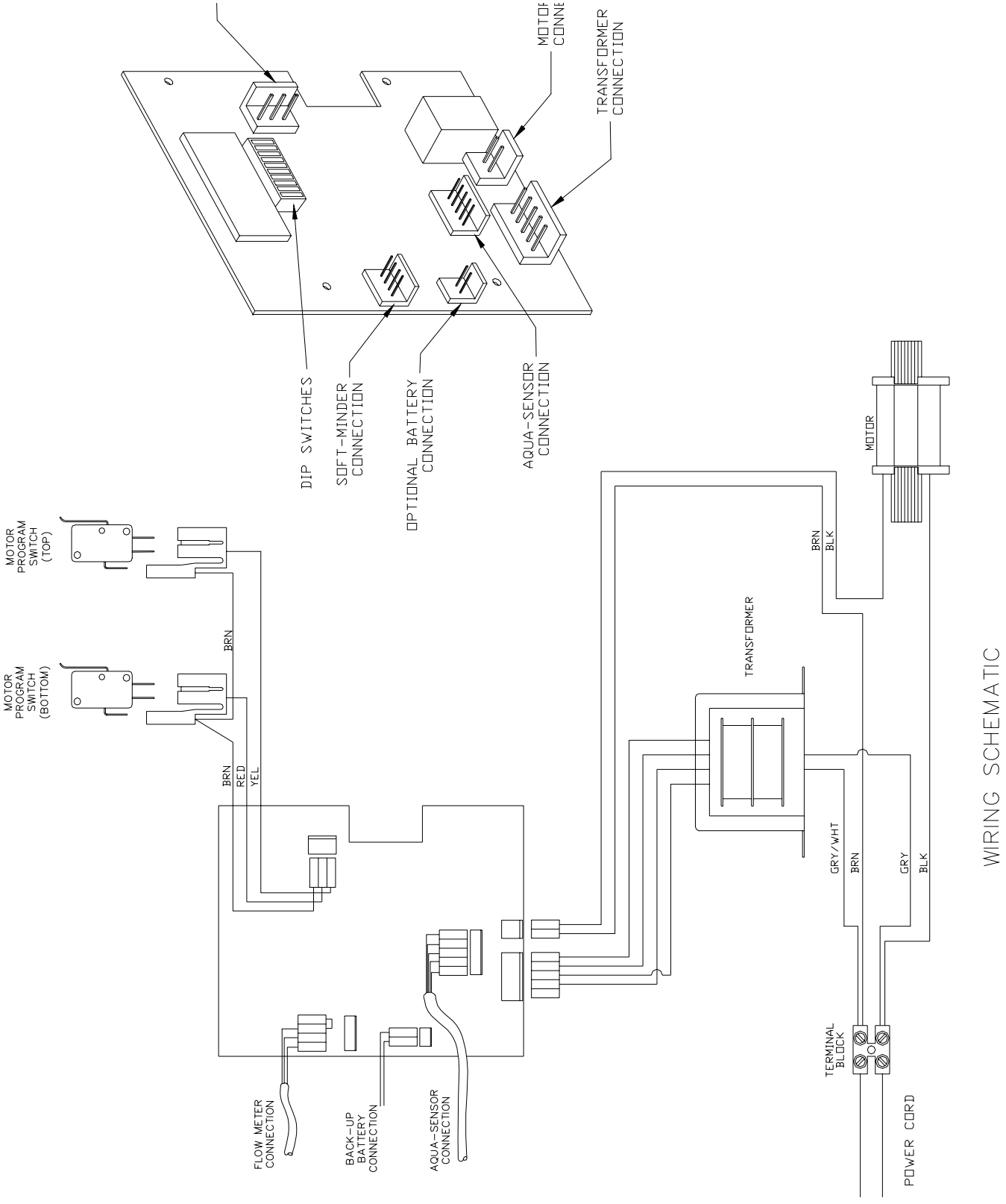
PROBLEM	CAUSE	SOLUTION
1. Unit has blank display.	A. Display is set to blank after 1 minute of no activity.	i. Refer to the 'Programming' section to disable the display blanking
	B. Unit has no power.	i. Verify that unit is connected to a constant power source. (Not an outlet on a switch)
	C. Defective plug-in transformer.	i. Replace plug-in transformer.
2. Softener fails to automatically initiate a regeneration.	A. Electrical service to the unit has been disrupted.	i. Verify that unit is connected to a constant power source. (Not an outlet on a switch)
	B. Soft-Minder® meter not properly recording total gallons used.	i. Verify that meter cable is plugged into circuit board.
	The flow meter connection and operation can be verified using the test mode setting on the circuit board.	ii. Verify that meter cable is snapped into flow meter housing.
		iii. Verify that flow meter has not become plugged with debris.
	C. Aqua-Sensor® probe not sensing hardness front.	i. Verify that Aqua-Sensor® connector is properly connected to circuit board.
	The Aqua-Sensor® connection and operation can be verified using the test mode setting on the circuit board.	ii. Verify that the Aqua-Sensor® probe is working. Clean probe if necessary.
	D. Incorrect programming.	i. Refer to the 'Programming' section and verify all settings.
3. Regeneration occurs at incorrect time.	A. Timer setting incorrect.	i. Reset timer.
	B. Timer flashing.	i. Reset timer and verify that unit is connected to a constant power source.
	C. Circuit board set to immediate regeneration.	i. Set circuit board to delayed regeneration by flipping dip switch 6 to the OFF position.
	D. Incorrect programming.	i. Refer to the 'Programming' section and verify all settings.

PROBLEM	CAUSE	SOLUTION
4. Phone Icon is displayed.	A. Jammed seal pack or brine piston.	i. Replace the seal pack or brine piston as outlined in the 'Parts Replacement Guide' section.
	B. Defective cam microswitches.	i. Replace cam microswitches.
	C. Defective motor.	i. Replace the motor as outlined in the 'Parts Replacement Guide' section.
5. Hard water to service.	A. Cul-Flo-Valv® is open or o-rings on Cul-Flo-Valv® bypass stem are cut.	i. Close bypass valve or replace o-rings on bypass stem.
The root cause of hard water to service may also lead to problems such as Iron or Hardness bleed in softeners.	B. Salt or Chemical storage tank is empty.	i. Add salt or chemical to storage tank and verify that proper level of salt or chemical is maintained.
	C. Eductor screen or nozzle plugged.	i. Clean or replace eductor nozzle and/or screen.
	D. Incorrect programming. (Salt dosage too low for influent hardness)	i. Refer to the 'Programming' section and verify that settings are correct.
	E. Insufficient water flowing to salt storage tank.	i. Verify that refill settings are correct, and clean the refill flow restrictor.
	F. Internal seal leak.	i. Replace seal pack as outlined in the 'Parts Replacement Guide' section.
	G. Excessive water usage.	i. Verify that programming is correct. For Time Clock units increase regeneration frequency.
	H. Unconditioned water in water heater tank.	i. Flush water heater to fill tank with conditioned water.
6. Loss of water pressure.	I. Inadequate mineral in media tank.	i. See problems 7 & 8.
	A. Control and/or resin bed plugged with debris or iron build-up.	i. Clean control and increase frequency of regenerations or length of backwash. Plant recondition if necessary.
	B. Inlet manifold plugged.	i. Remove control from tank and clean inlet manifold. Check if eductor screen/nozzle are also plugged.
	C. Control plugged with foreign material broken loose from recent plumbing work.	i. Clean control.

PROBLEM	CAUSE	SOLUTION
7. Loss of mineral to drain.	A. Improper drain line flow control.	i. Ensure that the control has the proper drain line flow control. (See Table 7)
	B. Air in water system.	i. Ensure that system has proper air eliminator control.
8. Mineral to service.	A. Control connected to tank backwards.	i. Verify that control is properly mounted to the tank. (White coupling on the right (inlet), black coupling on the left (outlet)).
	B. Defective outlet manifold.	i. Replace outlet manifold.
9. Water in storage tank up to float.	A. Secondary shut-off (brine valve float) not properly set.	i. Refer to "'A" Dimension Charts/Refill Rates' to set the brine valve float dimension.
	B. Plugged drain line flow control. (Unit will not draw brine)	i. Clean drain line flow control.
	C. Plugged eductor system. (Unit will not draw brine)	i. Clean eductor screen and nozzle.
	D. Slow leak to brine line. Faulty eductor sleeve or piston.	i. Replace eductor sleeve and piston.
	E. Power outage while control was in refill position.	i. Verify that items A-D are not the cause the extra water in the storage tank.
10. Excessive water in salt storage tank. (Water above brine valve float)	A. Faulty brine valve; float shut-off failure. *When the brine valve is faulty, one of the items listed under problem 9 is also required in order to produce excessive water in the storage tank.*	i. Clean brine valve, replace stem seat, or replace brine valve.
11. Unit fails to refill storage tank.	A. Refill restrictor plugged.	i. Clean or replace refill restrictor.
	B. Air in brine line causes float to slam shut. (float rod is rigid)	i. Verify that all tubing connections are properly assembled.

PROBLEM	CAUSE	SOLUTION
12. Unit fails to draw brine or chemical.	A. Drain line flow control is plugged.	i. Clean drain line flow control.
	B. Plugged eductor system.	i. Clean or replace eductor screen and nozzle.
	C. Line pressure too low.	i. Increase line pressure to a minimum of 20 psi (140 kPa).
	D. Internal control leak.	i. Replace seal pack and/or eductor sleeve/piston assembly.
	E. Drain line too long or restricted.	i. Verify proper drain line length. See 'Flow Rate and Drain Line Charts'.
	F. Eductor is drawing air into system.	i. Verify that all tubing connections are properly assembled.
13. Unit uses an excessive amount of salt or chemical.	A. Incorrect programming.	i. Refer to the 'Programming' section and verify all settings.
	B. Excessive water in storage tank.	i. Refer to problems 9 & 10.
14. Continuous flow to drain.	A. Internal seal pack leak.	i. Replace seal pack as outlined in the 'Parts Replacement Guide' section.
	B. Seal pack or brine piston jammed in position.	i. Replace the seal pack or brine piston as outlined in the 'Parts Replacement Guide' section.
	C. Power failure while unit was in regeneration.	i. Restore power to unit. Verify that unit is connected to a constant power source.
15. Salt water to service.	A. Inadequate Brine/Rinse setting for desired salt dosage.	i. Refer to the 'Programming' section and verify all settings.
	B. Low water pressure legthens brine draw time.	i. Increase line pressure to a minimum of 20 psi (140 kPa).
	C. Too much brine in the storage tank.	i. Refer to problems 9 & 10.

Wiring Diagram



“A” Dimension Charts/Refill Rates

The “A” dimension is the distance from the top of the filter screen of the brine valve chamber to the bottom edge of the lower float when the stem is in the fully raised position.

Refer to Table 8 for the correct “A” dimension (secondary shutoff) for the salt dosages on the water softener models. Adjust the “A” dimension as follows (Figure 8).

- Lift the brine valve from the brine chamber.
- Find the correct “A” dimension from Table 8.
- Set the distance from the top of the filter screen to the base of the float accordingly. The slight difference in height when the float is pulled up or down is negligible.
- Place the float assembly back in the chamber.

Refill Flow Control

As shipped from the factory, a 0.45 gpm refill flow control is used to control the refill flow rate. This is the standard refill rate as referenced in Table 8. An optional 0.80 gpm flow control is available (PN 00-4016-23). It is recommended that the 0.80 gpm flow control is used when salt dosages are greater than 15 lb. Replace the flow control as follows:

- Lift the brine valve from the brine chamber.
- Grasp the knurled top of the brine cap and unscrew it.
- Remove the 0.45 gpm flow control and replace with the 0.80 gpm control.
- Screw the top in and place the float back into the chamber.

NOTICE: When changing to the 0.80 gpm flow control, remove the 0.45 gpm label from the top of the brine cap. This will help to eliminate confusion at a future date.

NOTICE: When using the 0.80 gpm flow control, shift the #5 dip switch to the ON position. This enables the fast refill mode for the softener.

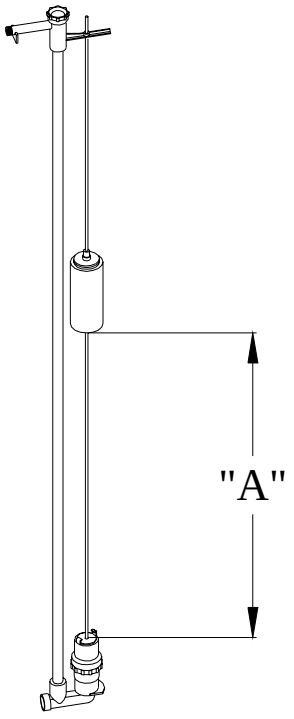


FIGURE 8

TABLE 8 - Brine Valve "A" Dimension

POUND SALT	REFILL TIME (MIN)		BRINE TANK "A" DIMENSION		
	STANDARD (0.45 gpm)	FAST (0.80 gpm)	160 LB (13")	250 LB (16")	375 LB (18")
3	2.23	1.30	6	5-1/4	4-1/2
4	3.08	1.73	7-3/4	6-5/8	5-1/2
5	3.83	2.17	9-1/2	8	6-1/2
6	4.62	2.63	11-1/4	9-3/8	7-1/2
7	5.38	3.03	13	10-7/8	8-1/2
8	6.15	3.47	14-3/4	12-1/4	9-1/2
9	6.92	3.90	16-1/2	13-5/8	10-1/2
10	7.70	4.32	18-1/4	15	11-1/2
11	8.47	4.75	20	16-3/8	12-1/2
12	9.23	5.18	21-3/4	17-3/4	13-1/2
13	10.00	5.63	23-1/2	19-1/8	14-1/2
14	10.77	6.07	25-1/4	20-1/2	15-1/2
15	11.53	6.50	—	21-7/8	16-1/2
16	12.30	6.93	—	23-1/4	17-1/2
17	13.08	7.35	—	24-5/8	18-1/2
18	13.85	7.78	—	26	19-1/2
19	14.62	8.22	—	27-3/8	20-1/2
20	15.38	8.65	—	28-3/4	21-1/2
21	16.15	9.08	—	—	22-1/2
22	16.92	9.53	—	—	23-1/2
23	17.68	9.95	—	—	24-1/2
24	18.47	10.38	—	—	25-1/2

CULLIGAN® MARK 100, 9" WATER CONDITIONER

EXTRA BRINE LINE

This column in the number of feet deducted from the allowable drain line length for each foot the brine line is extended beyond the standard 4-foot length.

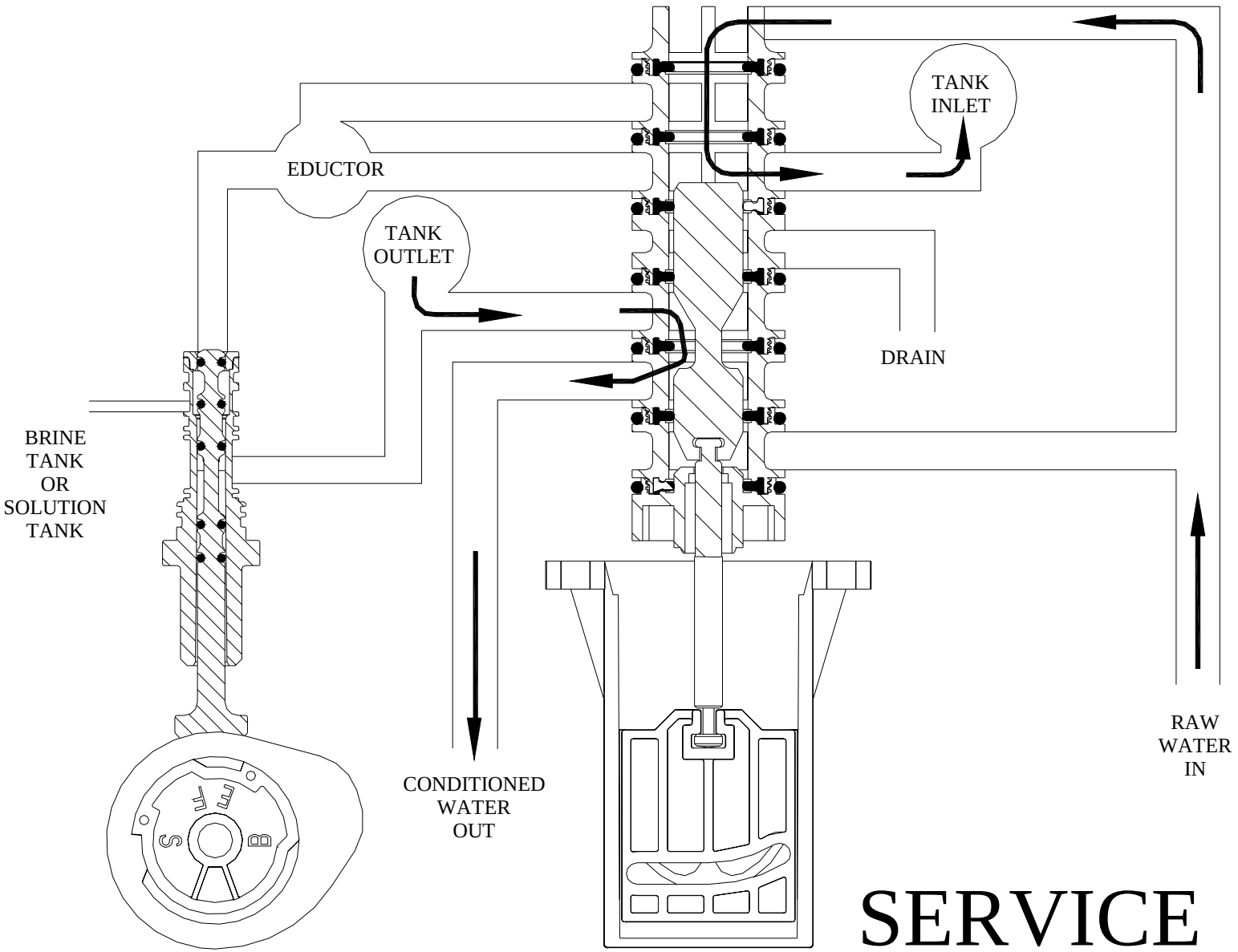
Min. Vac. Ht.	Back Wash gpm	Back Wash Sec./ Gal.	B/W Restric-tor No.	Rinse Rate gpm	Rinse Rate Sec./ Gal.	Fast Rinse Rate gpm	Fast Rinse Rate Sec./ Gal.	Eductor	Pres-sure psi	HEIGHT OF DRAIN DISCHARGE ABOVE FLOOR											Extra Brine Line
										4 in.	**1 ft.**	**2 ft.**	**3 ft.**	**4 ft.**	**5 ft.**	**6 ft.**	**7 ft.**	**8 ft.**	**9 ft.**	**10 ft.**	
				0.22	273				20												0.9
				Min.	Max.				25	33	27	17	7								1.2
									30	56	50	40	30	20	10						1.9
									35	74	68	58	48	38	28	18	8				2.1
									40	88	82	72	62	52	42	32	22	12			2.1
									45	100	94	84	74	64	54	44	34	24	14		2.2
									50	112	106	96	86	76	66	56	46	36	26	16	
									55	121	115	105	95	85	75	65	55	45	35	25	
									60	130	124	114	104	94	84	74	64	54	44	34	
									65	137	131	121	111	101	91	81	71	61	51	41	
19"	2.0	30	2	0.32	188	2.0	30	Blue	70	143	137	127	117	107	97	87	77	67	57	47	
				Avg.	Avg.				75	147	141	131	121	111	101	91	81	71	61	51	
									80	149	143	133	123	113	103	93	83	73	63	53	
									85	151	145	135	125	115	105	95	85	75	65	55	
									90	153	147	137	127	117	107	97	87	77	67	57	
									95	156	150	140	130	120	110	100	90	80	70	60	
									100	159	153	143	133	123	113	103	93	83	73	63	
									105												
									110												
				0.42	142				115												
				Max.	Min.				120												

SALT STORAGE ELEVATION

For each foot the salt storage tank is lowered below the floor on which the softener stands, it is necessary to deduct 8 feet of drain line from the allowable length shown on the chart. For each foot the salt storage tank is elevated above the floor on which the softener stands, the height of drain discharge can be raised 2 inches, or the total length of the drain line can be increased 4 feet. In either case, deduction must also be made for extra feet of brine line length in excess of the standard 4 feet. For this deduction, use column entitled, "EXTRA BRINE LINE".

CULLIGAN® MARK 100,12" WATER CONDITIONER

Min. Vac. Ht.	Back Wash gpm	Back Wash Sec./ Gal.	B/W Restric-tor No.	Rinse Rate gpm	Rinse Rate Sec./ Gal.	Fast Rinse Rate gpm	Fast Rinse Rate Sec./ Gal.	Eductor	Pres-sure psi	HEIGHT OF DRAIN DISCHARGE ABOVE FLOOR											Extra Brine Line
										4 in.	**1 ft.**	**2 ft.**	**3 ft.**	**4 ft.**	**5 ft.**	**6 ft.**	**7 ft.**	**8 ft.**	**9 ft.**	**10 ft.**	
				0.42	142				20	5											0.9
				Min.	Max.				25	18	12										1.0
									30	44	38	28	18								1.1
									35	62	56	46	36	26	16	6					1.2
									40	78	72	62	52	42	32	22	12				1.4
									45	93	87	77	67	57	47	37	27	17	7		1.6
									50	103	97	87	77	67	57	47	37	27	17	7	1.8
									55	110	104	94	84	74	64	54	44	34	24	14	2.0
									60	117	111	101	91	81	71	61	51	41	31	21	2.0
									65	122	116	106	96	86	76	66	56	46	36	26	2.1
19"	3.5	17	3	0.75	80	3.5	17	Beige	70	129	123	113	103	93	83	73	63	53	43	33	2.2
				Avg.	Avg.				75	133	127	117	107	97	87	77	67	57	47	37	2.3
									80	138	132	122	112	102	92	82	72	62	52	42	2.4
									85	142	136	126	116	106	96	86	76	66	56	46	2.5
									90	145	139	129	119	109	99	89	79	69	59	49	2.7
									95	147	141	131	121	111	101	91	81	71	61	51	2.9
									100	149	143	133	123	113	103	93	83	73	63	53	3.0
									105	151	145	135	125	115	105	95	85	75	65	55	3.0
									110	153	147	137	127	117	107	97	87	77	67	57	3.1
				1.08	55				115												
				Max.	Min.				120												


TANK
INLET
EDUCTOR
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BRINE
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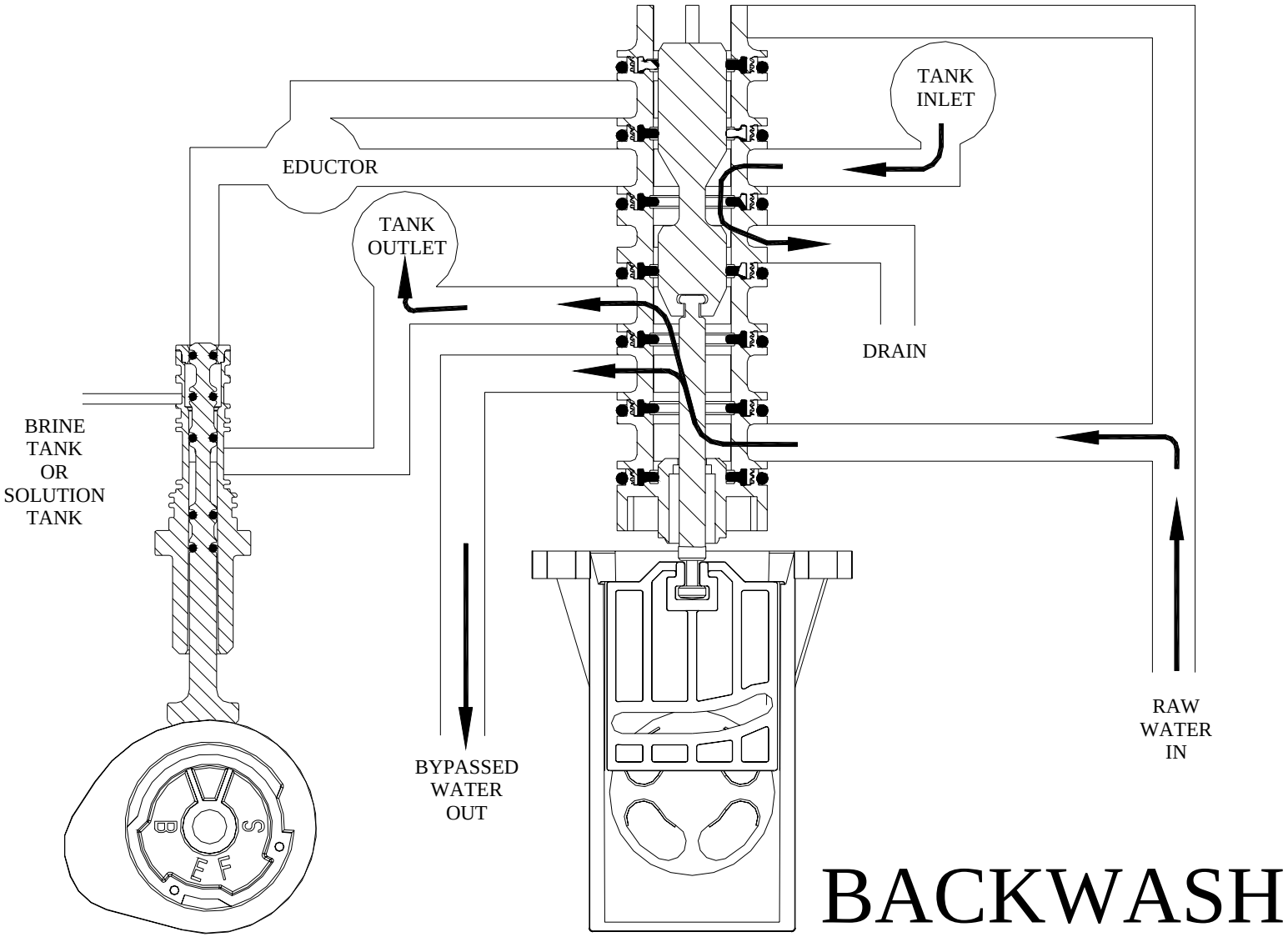
OR
SOLUTION
TANK
CONDITIONED
WATER
OUT
RAW
WATER
IN
SERVICE


TANK
INLET
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OR
SOLUTION
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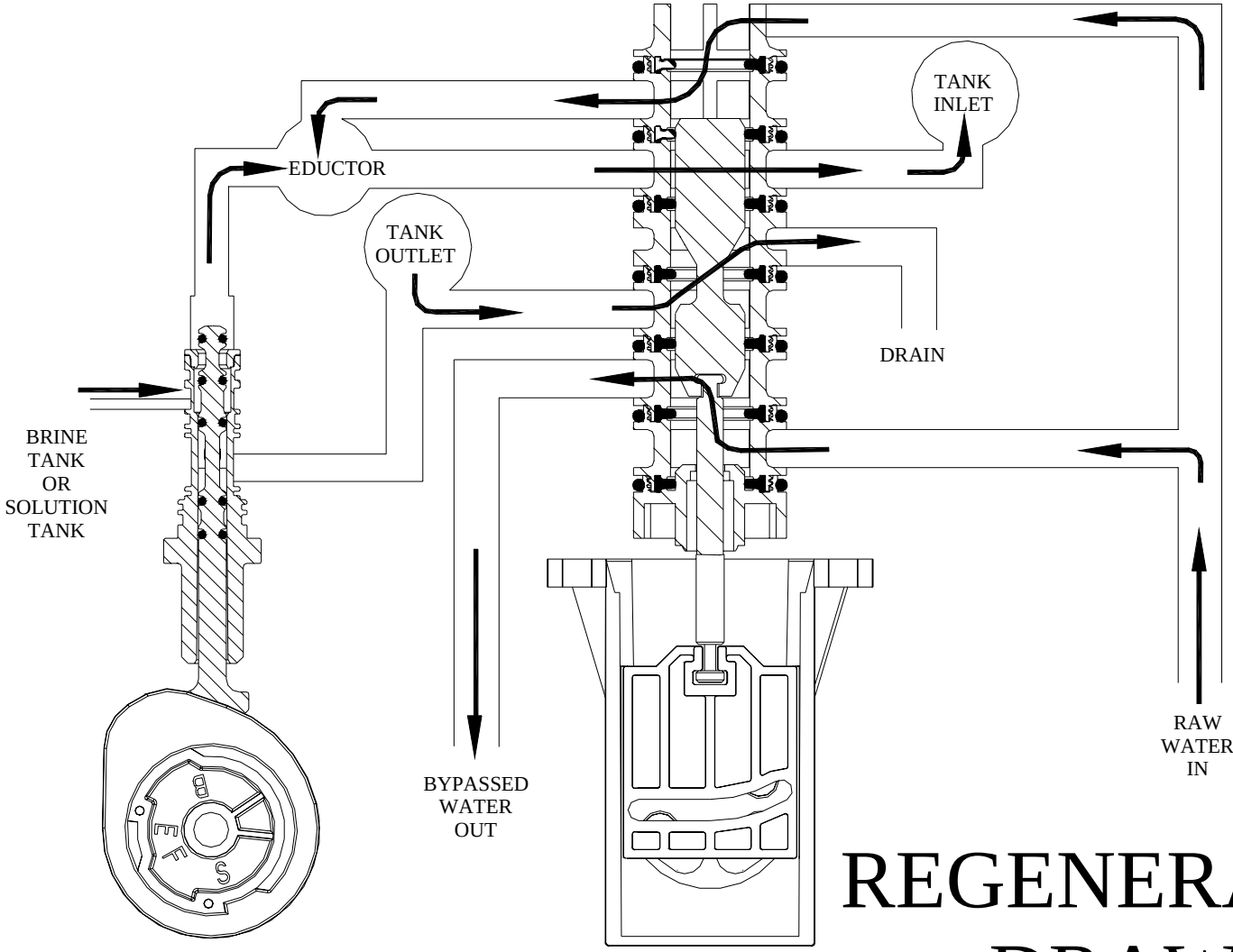
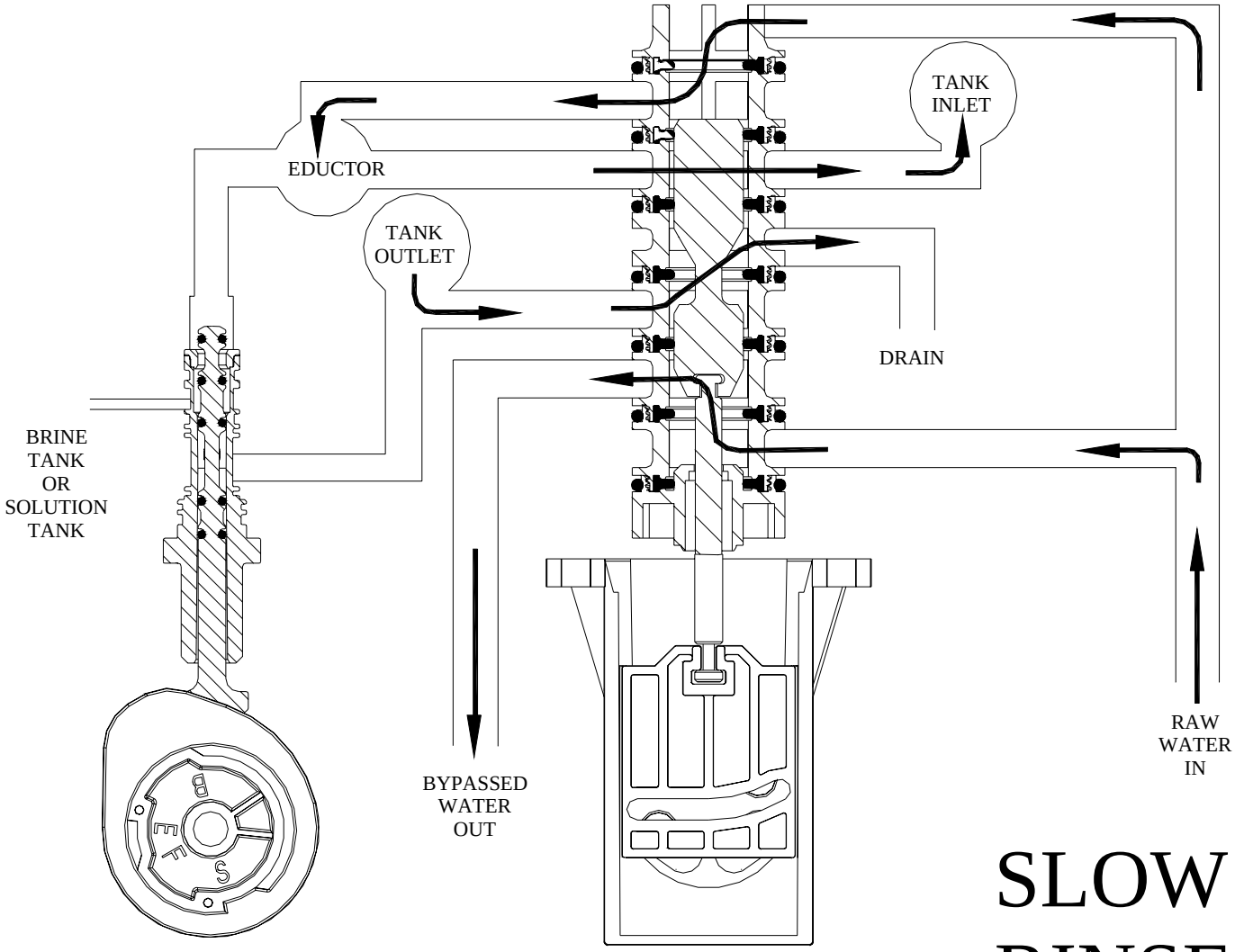
WATER
OUT
RAW
WATER
IN
BACKWASH



REGENERANT DRAW


TANK
INLET
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OR
SOLUTION
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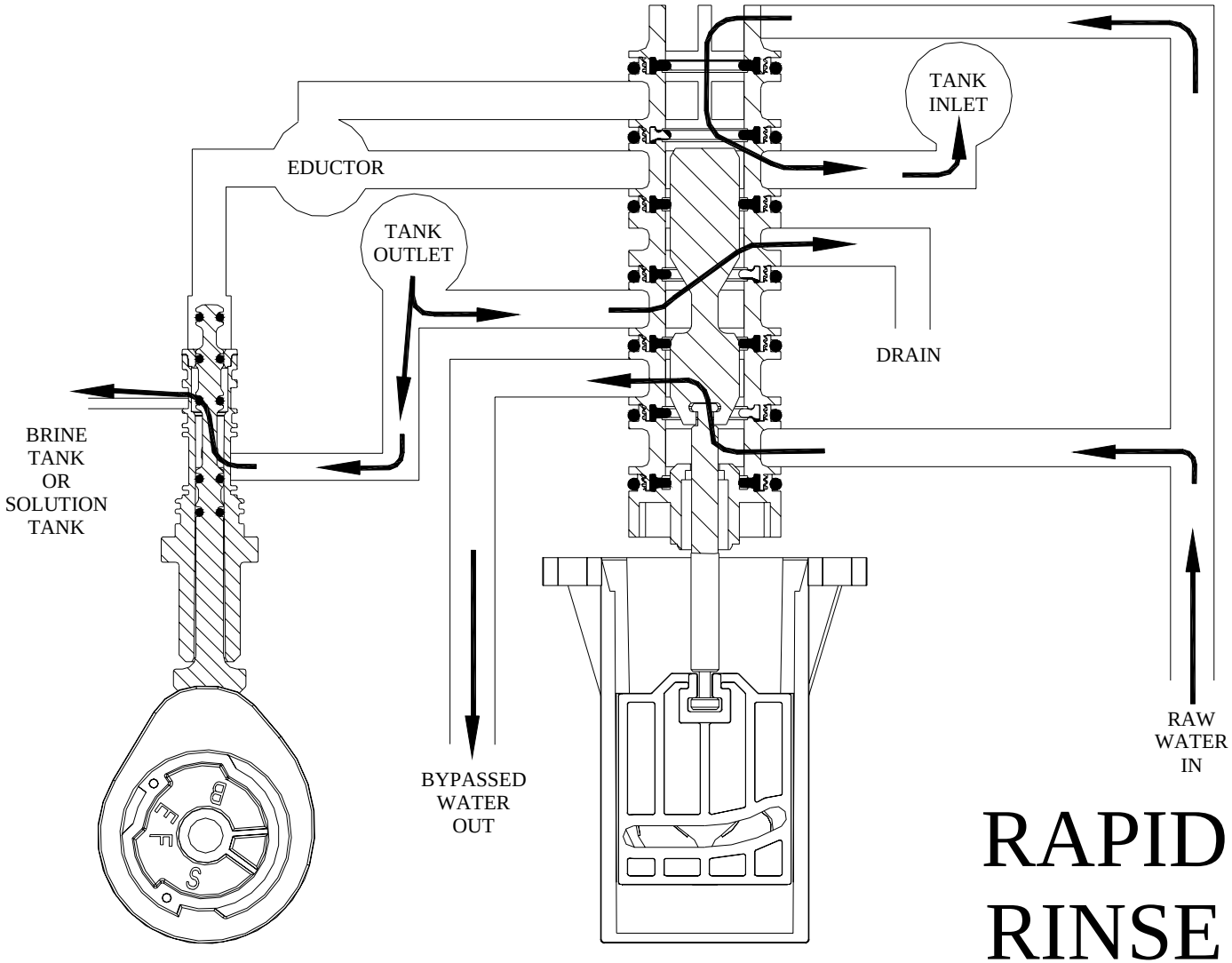
SLOW RINSE



RAPID RINSE & REFILL